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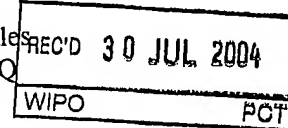I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

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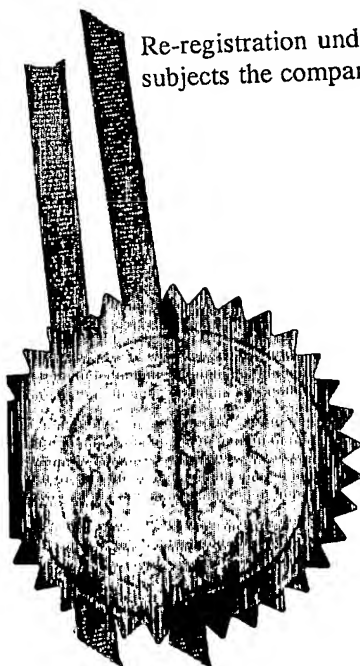
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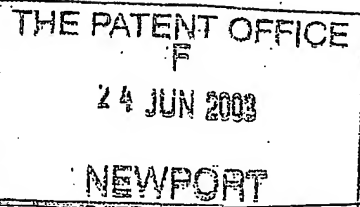
Signed   *Andrew Gorsey*

Dated   20 July 2004

Patents Form 1/77

Request for grant of a patent

1.	Your reference	TBS/BAR/37517.GBA
2.	Patent application number	0314659 4

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

Anthony Bruce PIKE 24 JUN 2003

10 Auckland Close
Upper Norwood 8659062001
London
SE19 2DN

Patents ADP number

If the applicant is a corporate body, give the country/state of its incorporation

4. Title of the invention

Medical Protection Sheeting

5. Name of your agent *(if you have one)*

Raworth Moss & Cook

"Address for service" in the United Kingdom to which all correspondence should be sent

36 Sydenham Road,
Croydon, Surrey, CR0 2EF

Patents ADP number

1362001

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number	Date of filing

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer yes if:*
a) *any applicant named in part 3 is not an inventor, or*
b) *there is an inventor who is not named as an applicant*
c) *any named applicant is a corporate body*

No

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9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document.

Continuation sheets of this form 0

Description 7

Claim(s) 0

Abstract 0

Drawing(s) 3

10. If you are also filing any of the following, state how many against each item.

Priority documents 0

Translations of priority documents 0

Statement of inventorship and right to grant of a patent *(Patents Form 7/77)* 0

Request for preliminary examination and search *(Patents Form 9/77)* 0

Request for substantive examination *(Patents Form 10/77)* 0

Any other documents *(please specify)* 0

11. I/We request the grant of a patent on the basis of this application

Signature   Date

23 June, 2003

12. Name and daytime telephone number of person to contact in the United Kingdom

Mr T Bain Smith
020 8688 8318

MEDICAL PROTECTION SHEETING

The present invention relates to medical protection sheeting
useful for patient handling and designed to reduce the risk
of damage to the skin of patients where this is damaged or
where it is subject to pressure.

Patient handling sheeting is known for turning patients or
lifting them between beds and trolleys and are sometimes
known as "slide sheets", a term which will be used below.
Where patients are severely injured, the movement between
beds and trolleys can be difficult with known slide sheets
since the material used for slide sheets is such as to cause
high initial resistance to sliding, that is, the coefficient
of friction rapidly rises as the sheet is pulled, reaching a
peak before sliding actually commences. The sheet then, so
to speak, becomes "unstuck". This sudden release from a
high frictional resistance is the frequent cause of damage
to a patient's skin, particularly where this has been burnt
or in other cases where the epidermis is damaged. In some
cases, this can cause separation of the dermal-epidermal
junction.

Even where the epidermis is not initially damaged, decubitus
ulcers or bedsores can form due to reduced blood flow in a
local area of skin slowing because of pressure. By
frequently changing body positions, this problem can be
solved.

Further problems occur with dressings which rub on bedding
or clothing. Again, high frictional coefficient between the
dressing and material with which it is in contact can cause
rucking of dressings and again epidermal damage.

According to the invention, there is provided medical
protection sheeting formed from a low frictional material

having a coefficient of static friction substantially the same as its coefficient of dynamic friction.

The advantage of such a material is that as the material
5   just starts to move over an adjacent material, which where possible is the same material, there is a smooth and gentle initiation and acceleration with no jerking. Thus epidermal damage is limited. Where slide sheets are made of the material of the invention, there is also less energy
10   required by those caring for the patient. Where there is a concern for bedsores, then the patient may himself be able to move alternatively and again less energy may be used by carers to frequently move the patient lying on the material.

15   Preferred materials have a coefficient of friction less than 0.4.

Preferably the material is a woven fabric to enable a certain amount of "breathing". The material should not be
20   too coarse and it is considered that materials having a linear density of 1000 to 40 decitex should be satisfactory. Materials of 470, 350 and 50 decitex have been tried and perform well. The materials weigh respectively for the 350 and 50 decitex material 180 and 61.7 gm/m^2. The finest
25   material used which performed well under test was DuPont Tactel (RTM) having nylon warp yarn 50F15T143 and nylon weft yarn 50F15T1943. A coarser fabric identified as 470T743 has been used with success. A medium weight fabric identified as DuPont's 350T749 was successfully used.

30

Embodiments of the invention will now be described by way of example with reference to the accompanying drawings and diagrams in which:-

35   Figure 1 is a diagram of a test rig to test materials for the invention;

Figure 2 shows test results from the rig of Figure 1 to
compare material according to the invention with linen so as
to indicate relative coefficients of friction;

5   Figure 3 is an extract from the results of Figure 2;

Figure 4 is a set of test results from the rig of Figure 1
showing how varying the relative orientation between samples
of the same material according to the invention varies the
10   friction between the samples; and

Figure 5 shows a bootee made with material according to the
invention.

15   Samples of DuPont (DTI) plain woven nylon fabric from which
slide sheets and dressing covering were made and were tried
out as follows:-

Parafricta (TM) Ref	DTI Ref	Linear Density (decitex)	Weight g/m^2	Gauge mm	Finished Threads per cm	Tensile Strength kN
P470	470T743	470		0.4	'24 x 20	
P350	350T749	350	180	<0.35		>2.3
P50	98Wext/4	50	61.7	0.15	61x47	6*

20
*Shear strength kN/m^2

Samples of P470 fabric were submitted to the test rig shown
in Figure 1 for the purpose of comparing its performance
25   with linen on a linen to linen basis, P470 to P470, P470 to
linen and linen to P470.

A block on flat measurement technique was used (Figure 1).
A 50 x 50 mm sledge S wrapped in test fabric T1 was pulled
30   over a flat plate F which was covered by a sheet of the
second fabric T2 to be tested. The sledge was pulled at a

constant speed of 1 mm per second using a steel wire and a
pulley by an Instron mechanical testing system LC. The load
that was needed to pull the sledge gives the friction load
and was recorded throughout the test. The sledge was loaded

5 by weights giving a 40 N vertical load during the test. The
friction coefficient is calculated as the frictional force
divided by the applied load.

The results are shown schematically in Figure 2, with the
10 main features given in Table 1. The highest friction values
were recorded for the linen rubbing against linen where the
static friction coefficient was 0.67 and the dynamic
friction coefficient was 0.44. By contrast the static
friction coefficient and dynamic friction coefficient were

15 about 0.2 for the P470 rubbing on itself. When P470 was
rubbing on linen, or linen on P470, the results were very
similar with a dynamic friction coefficient of about 0.3
with a slightly higher static friction coefficient. Figure
3 extracted from Figure 2 shows that static friction

20 increases rapidly from the application of a load until linen
stretches. The linen then suddenly starts to slide, at
which point the dynamic friction decreases rapidly.

Table 1, Main Results

25

Figure 2 Trace	Sledge Fabric (T1)	Flat Fabric (T2)	Static Friction	Dynamic Friction
12	Linen	Linen	0.67	0.44
11	P470	P470	0.19	0.21
13	P470	Linen	0.38	0.33
14	Linen	P470	0.33	0.29

Having completed the comparative tests of P470 against
linen, a second series of tests was conducted to determine
30 the effect of relative orientation as between warp and weft

of P470 material. The same rig (Figure 1) was used as in the first series of tests.

In the first set of the second series of tests, the load was recorded by chart recorder and then scanned and digitised to obtain digital results. For the second set of measurements, the load was recorded directly by a data logging system in a digital form.

The results are shown schematically in Figure 4, with the main features given in Table 2. The highest friction values were recorded for the linen rubbing against linen where the static friction coefficient was 0.67 and the dynamic friction coefficient was 0.44. By contrast, the static friction coefficient and dynamic friction coefficient were about 0.2 for the P470 rubbing on itself. When P470 was rubbing on linen, or linen on P470, the results were very similar, with a dynamic friction coefficient of about 0.3 with a slightly higher static friction coefficient. There was very little difference between the friction results for all the P470 on P470 tests.

The uncertainty of measurements of this type has not been studied definitively, but general experience of friction measurements would suggest that at an average friction level of about 0.2, the uncertainty in friction coefficient measurement is about 0.03.

Table 2, Further Results. Across is the direction on the P470 fabric parallel to the weft on the sample supplied. Along is perpendicular to this and parallel to the warp.

Figure 4 Trace	Sledge Fabric T1	Flat Fabric T2	Static Friction	Dynamic Friction
	Linen	Linen	0.67	0.44
24	P470 – Along	P470 – Along	0.19	0.21

	P470 – Along	Linen	0.38	0.33
	Linen	P470 – Along	0.33	0.29
21	P470 – Along	P470 – Across	0.24	0.24
22	P470 – Diagonal	P470 – Across	0.21	0.21
23	P470 – Across	P470 – Across	0.23	0.23

Trace 21 marked "crossed" on Figure 4 indicates the Sledge and Flat fabrics are orientated warp to weft or Along/Across.

The comparative second series of tests showed that the P470 material was best aligned to another sample of itself so that both the warp threads were parallel, that the movable sheet was pulled in the warp direction and remarkably that the static friction was slightly less than the dynamic friction. The most unfavourable relative orientation was when the P470 materials were warp to weft or "crossed". However, as long as P470 was arranged to slide on P470, there was no great difference in the coefficient of friction for any relative orientation. In none of the relative orientations was there any great difference and most had the same static and dynamic coefficient of friction. This showed that unlike the linen on linen case shown in Figure 3, there was no tendency for sudden jerking when using P470 to P470 in juxtaposition. Sudden jerking would result in sudden uncontrolled motion.

Although it is desirable to use P470 to P470, the results of the tests of P470 to linen show that this is considerably better than using linen to linen. Furthermore, when using P470 to linen, it is best to pull the P470 in the warp

direction when on linen.   It is therefore preferable when
making a slip sheet (often about 120 x 70 cm or 145 x 72 cm)
to cut the material so that the long side of the sheet runs
parallel with the weft.   Obviously, a range of sizes may be
5   supplied up to about 200 cm long and up to 100 cm wide.

It will be observed that when using the material of the
invention as a slide sheet, the force F to pull the sheet
under a patient of weight W, the force required where μ is
10   the coefficient of friction and g is the acceleration due to
gravity, that $F = 2\mu gW$, where static μ (μs) is much greater
than dynamic μd, then F is increasingly greater to start
moving the patient.   Generally it can be shown that the
material of the invention requires only about half the
15   effort (F) when compared to a sliding linen over linen.
Also, the material can be made strong for any given weight
of material.

Generally, μs should be no more than 20% greater than μd and
20   both should be less than 0.4.

When using the material of the invention as a covering for a
dressing, for example, as shown in Figure 5 which is in the
form of a bootee 30 with a Lycra (RTM) collar 32, adjustable
25   Velcro (RTM) closers 33 and externally seamed 34, a finer
material such as P50 is preferred.   Other forms (not shown)
of covering for dressings are provided but which are also
shaped to other particular parts of the body.

30   A particular application of the covering according to the
invention is to protect dressings comprising advanced
materials such as hydrocolloids which could include active
materials to protect against infection or promote healing.
Although these dressings may be more expensive than
35   conventional dressings, the protection given by the covering
of the invention enables these advanced dressings to remain
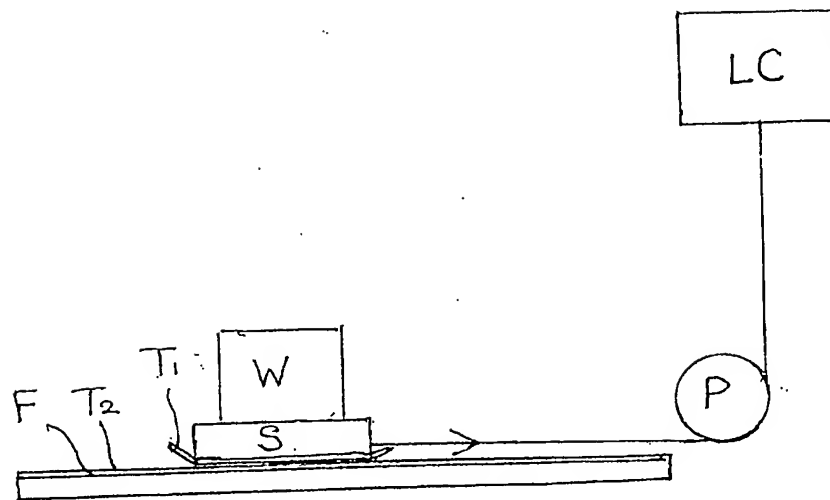in place longer.   Therefore cost savings ensue.
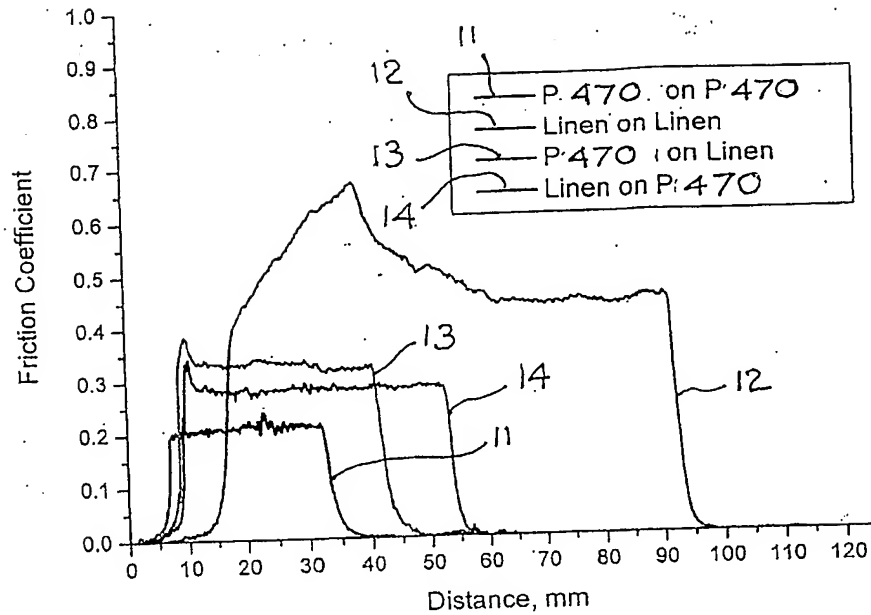
Figure 1

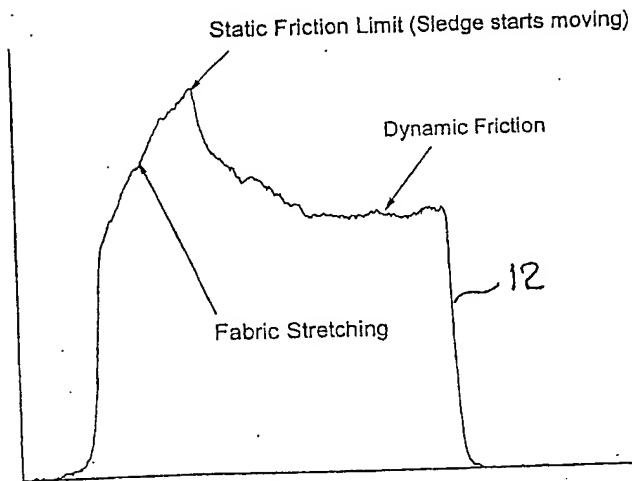Figure 2, Variation in friction coefficient with sliding distance

Figure 3, Illustration of static and dynamic friction using linen on linen results as an example.
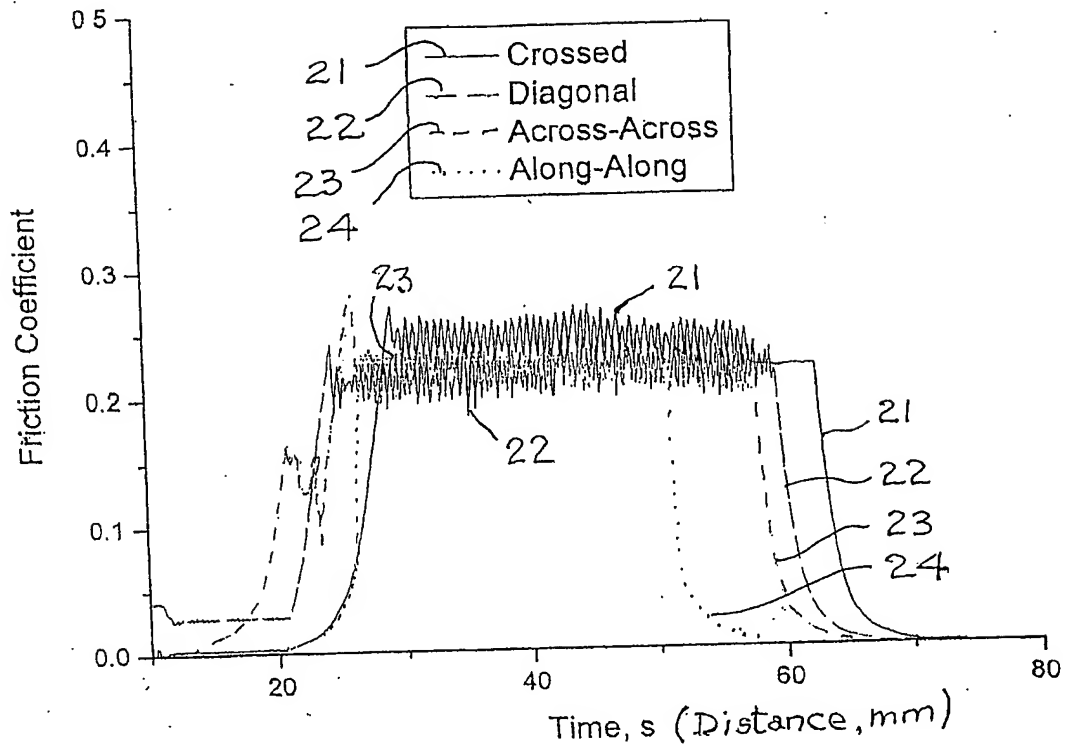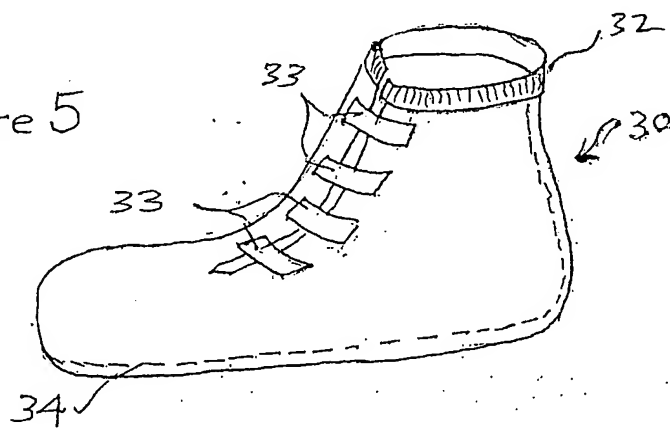
Figure 4.

Legend:
- 21 — Crossed
- 22 — Diagonal
- 23 — Across-Across
- 24 — Along-Along

Friction Coefficient (y-axis: 0.0 to 0.5)

Time, s (Distance, mm) (x-axis: 20, 40, 60, 80)

Figure 5